Earth Solutions NW LLC

Geotechnical Engineering
Geology
Environmental Scientists
Construction Monitoring

GEOTECHNICAL ENGINEERING STUDY
LAYTON CROSSING
PROPOSED RESIDENTIAL DEVELOPMENT
14521 - 11TH AVENUE NORTHEAST
SHORELINE, WASHINGTON

RECEIVED
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PERMIT CENTER

ES-3304

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PREPARED FOR

SUNDQUIST HOMES, LLC

May 5, 2014
Updated May 9, 2014

Henry T. Wright, E.I.T.
Staff Engineer

5/12/14

Raymond A. Coglas, P.E.
Principal

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Important Information About Your

Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

The following information is provided to help you manage your risks.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual

subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely, on Your ASFE-Member Geotechncial Engineer for Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you ASFE-member geotechnical engineer for more information.

ASFE
The Best People on Earth

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Earth Solutions NW LLC

- Geotechnical Engineering
- Construction Monitoring
- Environmental Sciences

May 5, 2014
Updated May 9, 2014
ES-3304

Sundquist Homes, LLC
16108 Ash Way, Suite 201
Lynnwood, Washington 98087

Attention: Mr. Bill Keith

Dear Mr. Keith:

Earth Solutions NW, LLC (ESNW) is pleased to present this report titled "Geotechnical Engineering Study, Layton Crossing Proposed Residential Development, 14521 – 11th Avenue Northeast, Shoreline, Washington". This study has been updated to incorporate the current grading and stormwater plans.

The site is underlain primarily by medium dense to dense glacial till deposits. In our opinion, the proposed development is feasible from a geotechnical standpoint and the proposed residential structures can be supported on conventional continuous and spread footing foundations bearing on competent native soils, or structural fill underlain by competent native soils. Competent soils suitable for support of foundations should be encountered at depths of approximately one and one-half to four feet below existing grades. Where loose or unsuitable soil conditions are exposed at foundation subgrade elevations, compaction of the soils to the specifications of structural fill, or overexcavation and replacement with a suitable structural fill material will be necessary. Based on the results of our investigation, in our opinion, the proposed development should incorporate a structure setback of 25 feet from the top of the steep slope areas located to the west and south of the proposed development area.

A critical areas assessment and recommendations for foundation design, retaining wall design, drainage, and other pertinent recommendations are provided in this study.

We appreciate the opportunity to be of service to you on this project. If you have questions regarding the content of this geotechnical engineering study, please call.

Sincerely,

EARTH SOLUTIONS NW, LLC

Raymond A. Coglas, P.E.
Principal

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INTRODUCTION

General

This geotechnical engineering study was prepared for the proposed residential development to be constructed at 14521 – 11th Avenue Northeast in Shoreline, Washington. The approximate location of the subject property is illustrated on the Vicinity Map (Plate 1). This study provides a critical areas assessment and geotechnical recommendations for the proposed site development. Test pit excavations and laboratory testing of soil samples were completed to characterize subsurface conditions. The scope of services for completing this geotechnical engineering study included the following:

- Subsurface exploration and characterization of soil and groundwater conditions by excavating a series of test pits within accessible locations of the property;
- Laboratory testing of soil samples obtained during subsurface exploration;
- Engineering analyses and recommendations for the proposed development, and;
- Preparation of this report.

The following documents/maps were reviewed as part of our report preparation:

- Layton Crossing Site Plan, prepared by LDC Engineering, dated April 2, 2014;
- Layton Crossing Slope Analysis Map, prepared by LDC Engineering, dated April 8, 2014; ?
- Shoreline Municipal Code, Chapter 20.80;
- Engineering Development Manual, Chapter 22, prepared by City of Shoreline, dated 2012;
- Geologic Map of Seattle, prepared by Troost, Booth, Wisher, and Shimel, and;
- Stormwater Management in Western Washington (DOE Manual), Section 3.3.6, prepared by Washington State Department of Ecology, dated February 2005.

Project Description

Based on the referenced plans provided to us, the subject site will be developed with two single-family residential structures, infiltration/dispsersion trenches, an access roadway, and associated improvements. Based on the referenced plans, grading activities will involve cuts and fills of up to nine feet to establish level building pads.

The proposed residential structures are anticipated to consist of relatively lightly-loaded wood framing supported on conventional foundations. Based on our experience with similar developments, we estimate wall loads on the order of two kips per lineal foot and slab-on-grade loading of 150 pounds per square foot (psf).

If the above design assumptions are incorrect or change, ESNW should be contacted to review the recommendations in this report. ESNW should review the final design to confirm that our geotechnical recommendations have been incorporated into the plans.

SITE CONDITIONS

Surface

The subject site is located at 14521 – 11th Avenue Northeast in Shoreline, Washington, as illustrated on the Vicinity Map (Plate 1). The site consists of one residential tax parcel (King County parcel number 6632900830) covering approximately 1.59 acres of land area. Based on review of historic imagery of the site provided by the King County iMap parcel view, the property was previously developed with two to three single-family residential structures, and previous grading along the easterly and northeasterly portions of the site is evident. The previous structures have been previously demolished and the site is currently undeveloped.

The proposed development area consists of relatively level areas through the previous building pads with gentle slopes throughout the remainder of the area. The site descends to the west-northwest to 10th Avenue Northeast and to the south to Northeast 145th Street. Based on the referenced slope analysis map, the sloped areas to the west-northwest and south of the proposed development area are inclined 40 percent or greater. The slope to the south of the proposed development area appears to be the result of previous grading activity associated with the construction of Northeast 145th Street. The easterly and northeasterly portions of the site appear to have been previously graded and the existing grade in the northeasterly portion of the site appears to be approximately six to eight feet lower than the original grade.

The site is bordered to the north by Paramount Park and single-family residences, to the east by single-family residences, to the west by 10th Avenue Northeast with single-family residences beyond, and to the south by Northeast 145th Street with Jackson Park Golf Course beyond. The Test Pit Location Plan (Plate 2) illustrates the approximate local topography and limits of the property.

Slope Reconnaissance

During our fieldwork, we performed a visual slope reconnaissance across portions of the identified steep slope areas of the site. The main focus of our reconnaissance was to identify signs of instability or erosion hazards along the site slopes. The slope reconnaissance revealed that the steep slope south of the proposed development envelope is likely the result of previous grading activity associated with the construction of Northeast 145th Street and the slope to the west-northwest appears to be a naturally occurring slope. The slope to the south is vegetated with trees and grass groundcover, and the slope to the west-northwest is vegetated with mature trees and consistent ferns and ivy groundcover. During the slope reconnaissance, no signs of large-scale erosion or landslide events were observed. The overall global stability of the steep slope areas and sloped portions of the site can be characterized as good based on our observations.

An ecology block wall up to eight feet in height is located along the east property line, and an ecology block wall up to two feet in height is located along the south property line. Both ecology block walls appeared stable in the condition and configuration observed during our fieldwork.

Approximate Original Grade

The northeast corner of the site (location of proposed structure 2) appears to have been cut down below original grade. The topography to the west and north of the location of proposed structure 2 is elevated up to approximately ten feet higher and the ecology block wall immediately to the east is up to approximately eight feet in height. Based on the surrounding topography and ecology block wall, we estimate the original grade through the northeast corner of the site (location of proposed structure 2) was approximately six to ten feet higher than the existing grade.

Subsurface

Five test pits were excavated on accessible portions of the site on April 9, 2014 for the purpose of assessing the soil and groundwater conditions. Please refer to the test pit logs provided in Appendix A for a more detailed description of the subsurface conditions.

Topsoil was observed in the upper approximately four to six inches. The topsoil was characterized by dark brown color and the presence of fine organic material.

Fill was encountered at test pit locations TP-1 and TP-3 consisting primarily of loose to medium dense silty sand with gravel. The fill observed at test pit location TP-3 contained an abundant amount of brick and concrete rubble, and is likely residual fill from the disturbance associated with the construction and demolition of the previous structures. We anticipate minor amounts of fill and rubble material will be encountered throughout the previous building pad areas.

Underlying the topsoil and fill, native soils consisting primarily of medium dense to dense silty sand with gravel (Unified Soil Classification SM) glacial till deposits were encountered extending to the maximum exploration depth of eight feet below existing grades. The unweathered glacial till exposed at depth was observed to generally be in a dense cemented condition.

The referenced geologic map resource identifies Vashon till (Qvt) throughout the site and Vashon recessional outwash (Qvr) deposits to the west of the site. The native soil conditions observed at the test pit locations are consistent with glacial till deposits.

Groundwater

Groundwater seepage was not observed during our subsurface exploration. However, perched groundwater seepage should be expected in deeper site excavations. Groundwater seepage rates and elevations fluctuate depending on many factors, including precipitation duration and intensity, the time of year, and soil conditions. In general, groundwater elevations and flow rates are higher during the winter, spring and early summer months.

CRITICAL AREAS ASSESSMENT

Review of the King County iMAP online resource indicates the majority of the site is located within an erosion hazard area, and review of available project information indicates the slopes immediately west and south of the proposed development envelope qualify as landslide hazard areas. The referenced chapter of the Shoreline Municipal Code was reviewed as part of this critical areas assessment.

Erosion Hazard

Section 20.80.220 of the Shoreline Municipal Code defines erosion hazard areas as "lands or areas underlain by soils identified by the U.S. Department of Agriculture Natural Resources Conservation Service (NRCS) (formerly the Soil Conservation Service) as having 'severe' or 'very severe' erosion hazards. This includes, but is not limited to, the following group of soils when they occur on slopes of 15 percent or greater: Alderwood-Kitsap (AkF), Alderwood gravelly sandy loam (AgD), Kitsap silt loam (KpD), Everett (EvD) and Indianola (InD)."

The soil observed throughout the site would classify as Alderwood gravelly sandy loam. Based on the previously defined criteria, the sloped portions of the site would qualify as erosion hazards.

As discussed in the *Slope Reconnaissance* section of this report, the sloped portions of the site do not exhibit any signs of large-scale erosion. In our opinion, the soils within the proposed development envelope of the site would present a low erosion hazard and the soils within the steeply sloped portions of the site to the west and south of the proposed development envelope would present a moderate erosion hazard. Provided the recommendations in this report relating to grading and erosion control activities are incorporated into site designs, the potential for erosion or off-site migration of soil will be low.

Landslide Hazard

Section 20.80.220 of the Shoreline Municipal Code defines landslide hazard areas as follows:

1. Moderate Hazard: Areas with slopes between 15 percent and 40 percent and that are underlain by soils that consist largely of sand, gravel or glacial till.
2. High Hazard: Areas with slopes between 15 percent and 40 percent that are underlain by soils consisting largely of silt and clay.
3. Very High Hazard: Areas with slopes steeper than 15 percent with zones of emergent water (e.g., springs or ground water seepage), areas of landslide deposits regardless of slope, and all steep slope hazard areas sloping 40 percent or steeper.

As previously discussed, steep slopes of 40 percent or greater have been identified to the west and south of the proposed development envelope. Based on visual slope reconnaissance, the steep slope area to the west appears to primarily consist of a naturally occurring slope and the steep slope area to the south appears to be the result of previous grading activities associated with the construction of Northeast 145th Street.

Preliminary plans indicate the development will not encroach within the steep slope areas. As discussed in the *Slope Reconnaissance* section of this report, no signs of historic instability were observed and the site slopes exhibit good overall global stability. Based on visual slope reconnaissance and subsurface exploration, in our opinion, the proposed development should incorporate a structure setback of 25 feet from the top of the steep slope areas. In our opinion, the proposed grading and activities adjacent to the top of the steep slope areas (within the 25 foot structure setback) is feasible and will not increase the critical areas hazard. In our opinion, infiltration trenches should be setback at least 20 feet from the top of the steep slope areas. If the recommendations within this report are followed, in our opinion, the proposed development and associated grading activities are feasible from a geotechnical standpoint and the proposed development will not increase the critical area hazard for the site or surrounding properties.

DISCUSSION AND RECOMMENDATIONS

General

In our opinion, construction of the proposed single-family residential structures and related improvements at this site is feasible from a geotechnical standpoint. In our opinion, the proposed structures can be supported on conventional continuous and spread footing foundations bearing on competent native soils, or structural fill underlain by competent native soils. Slab-on-grade floors should be supported on dense native soil, recompacted native soil, or structural fill. Competent soils suitable for support of foundations should be encountered at depths of approximately one and one-half to four feet below existing grades across the majority of the site. Where existing fill, loose or unsuitable soil conditions are exposed at foundation subgrade elevations, overexcavation and replacement with a suitable structural fill material will be necessary. Organic material exposed at subgrade elevations must be removed below design elevation and grades restored with structural fill. Recommendations for foundation design, retaining wall design, drainage, and other pertinent recommendations are provided in the following sections of this study.

This study has been prepared for the exclusive use of Sundquist Homes, LLC and their representatives. No warranty, expressed or implied, is made. This study has been prepared in a manner consistent with the level of care and skill ordinarily exercised by other members of the profession currently practicing under similar conditions in this area.

Site Preparation and Earthwork

Site preparation activities will include installing erosion control features, and stripping activities. Erosion control measures should be in place prior to stripping and grading activities commence. Earthwork activities will include grading to establish building pads.

Temporary Erosion Control

Temporary construction entrances and drive lanes, consisting of at least one foot of quarry spalls can be considered in order to minimize off-site soil tracking and to provide a stable access entrance surface. Erosion control measures should include silt fencing placed along the edge of the site and at the top of the steep slope areas of the site. Soil stockpiles should be covered or otherwise protected to reduce soil erosion. Temporary sedimentation ponds or other approaches for controlling surface water runoff should be in place prior to beginning significant earthwork activities and should direct surface water away from the steep slope areas of the site.

Site Stripping Recommendations

Stripping will likely be limited to about four to six inches throughout the majority of the proposed development envelope. Topsoil and organic-rich soil is not suitable for foundation support, nor is it suitable for use as structural fill. Topsoil or organic-rich soil can be used in non-structural areas, if desired. The geotechnical engineer should observe stripping operations to confirm the necessary stripping depth. Care should be taken to avoid over-stripping. Earthwork activities will include grading to establish building pads and road access.

In-situ Soils

The soils encountered throughout the majority of the test sites have a moderate to high sensitivity to moisture and were generally in a moist condition at the time of the exploration on April 9, 2014. In general, soils encountered during site excavations that are excessively over the optimum moisture content will require aeration or treatment prior to placement and compaction. Conversely, soils that are substantially below the optimum moisture content will require moisture conditioning through the addition of water prior to use as structural fill. If the in-situ soils are determined to not be suitable for use as structural fill, then use of a suitable imported soil may be necessary.

Imported Soils

Imported soil intended for use as structural fill should consist of a well-graded granular soil with a moisture content that is at or near the optimum level. During wet weather conditions, imported soil intended for use as structural fill should consist of a well-graded granular soil with a fines content of 5 percent or less defined as the percent passing the Number 200 sieve, based on the minus three-quarter inch fraction.

Structural Fill

Structural fill is defined as compacted soil placed in foundation, slab-on-grade, and roadway areas. Fills placed to construct permanent slopes and throughout retaining wall and utility trench backfill areas are also considered structural fill. Soils placed in structural areas should be placed in loose lifts of 12 inches or less and compacted to a relative compaction of 90 percent, based on the laboratory maximum dry density as determined by the Modified Proctor Method (ASTM D-1557). For soil placed in utility trenches underlying structural areas compaction requirements are dictated by the local city, county or utility district, and in general are specified as 95 percent relative compaction. Soil placed within the upper 12 inches of slab-on-grade and pavement subgrade areas should also be compacted to a relative compaction of at least 95 percent.

Excavations and Slopes

The Federal Occupation Safety and Health Administration (OSHA) and the Washington Industrial Safety and Health Act (WISHA) provide soil classification in terms of temporary slope inclinations. Based on the soil conditions encountered at the test pit locations, the native weathered till soils encountered in the upper two to four feet at the test pit locations and where no fill and/or groundwater seepage is exposed are classified as Type B by OSHA/WISHA. Temporary slopes over four feet in height in Type B soils must be sloped no steeper than 1H:1V. Excavations in which fill and/or groundwater seepage is exposed would be classified as Type C by OSHA/WISHA. Temporary slopes over four feet in height in Type C soils must be sloped no steeper than 1.5H:1V. Native unweathered till soils where no fill and/or groundwater seepage is exposed are classified as Type A by OSHA/WISHA. Temporary slopes over four feet in height in Type A soils must be sloped no steeper than 0.75H:1V. The presence of perched groundwater may cause caving of the temporary slopes due to hydrostatic pressure. ESNW should observe site excavations to confirm the soil type and allowable slope inclination are appropriate for the soil exposed by the excavation. If the recommended temporary slope inclination cannot be achieved, temporary shoring may be necessary to support excavations.

Permanent slopes should maintain a gradient of 2H:1V, or flatter, and should be planted with vegetation to enhance stability and to minimize erosion. A representative of ESNW should observe temporary and permanent slopes to confirm the slope inclinations are suitable for the exposed soil conditions, and to provide additional excavation and slope recommendations, as necessary.

Foundations

Based on the results of our study, the proposed single-family residential structures can be supported on conventional spread and continuous footings bearing on competent native soils, or structural fill underlain by competent native soils. Based on the soil conditions encountered at the test sites, competent native soils suitable for support of foundations should be encountered at depths of approximately one and one-half to four feet below existing grades. Where loose or unsuitable soil conditions are exposed at foundation subgrade elevations, compaction of the soils to the specifications of structural fill, or overexcavation and replacement with structural fill will be necessary. Organic material exposed at foundation subgrade elevations must be removed and grades restored with structural fill.

Provided foundations will be supported as described above, the following parameters can be used for design of new foundations:

- Allowable soil bearing capacity — 2,500 psf
- Passive earth pressure — 350 pcf (equivalent fluid)
- Coefficient of friction — 0.40

A one-third increase in the allowable soil bearing capacity can be assumed for short-term wind and seismic loading conditions. The above passive pressure and friction values include a factor-of-safety of 1.5.

With structural loading as expected, total settlement in the range of one inch and differential settlement of about one-half inch is anticipated. The majority of the settlements should occur during construction, as dead loads are applied.

Seismic Design Considerations

The 2012 IBC recognizes ASCE for seismic site class definitions. If the project will be permitted under the 2012 IBC, in accordance with Table 20.3-1 of ASCE, Minimum Design Loads for Buildings and Other Structures, Site Class C, should be used for design.

In our opinion, liquefaction susceptibility at this site is low. The relative density of the site soils and the absence of a uniform, shallow groundwater table are the primary bases for this designation.

Slab-On-Grade Floors

Slab-on-grade floors constructed at this site should be supported on a firm and unyielding subgrade. Where feasible, the existing native soils exposed at the slab-on-grade subgrade level can be compacted in place to the specifications of structural fill. Unstable or yielding areas of the subgrade should be recompacted or overexcavated and replaced with structural fill prior to construction of the slab. A capillary break consisting of a minimum of four inches of free-draining crushed rock or gravel should be placed below the slab. The free-draining material should have a fines content of 5 percent or less defined as percent passing the Number 200 sieve, based on the minus three-quarter inch fraction. In areas where slab moisture is undesirable, installation of a vapor barrier below the slab should be considered. If a vapor barrier is to be utilized it should be a material specifically designed for use as a vapor barrier and should be installed in accordance with the manufacturer's specifications.

Retaining Walls

Retaining walls must be designed to resist earth pressures and applicable surcharge loads. The following parameters can be used for retaining wall design:

- Active earth pressure (yielding condition) — 35 pcf (equivalent fluid)
- At-rest earth pressure (restrained condition) — 50 pcf
- Traffic surcharge for passenger vehicles (where applicable) — 70 psf (rectangular distribution)
- Passive earth pressure — 350 pcf (equivalent fluid)
- Coefficient of friction — 0.40
- Seismic surcharge (where applicable) — 6H (where H equals retained height)

Additional surcharge loading from adjacent foundations, sloped backfill, or other loads should be included in the retaining wall design. Drainage should be provided behind retaining walls such that hydrostatic pressures do not develop. If drainage is not provided, hydrostatic pressures should be included in the wall design.

Retaining walls should be backfilled with free draining material that extends along the height of the wall, and a distance of at least 18 inches behind the wall. The upper one foot of the wall backfill can consist of a less permeable soil, if desired. A perforated drain pipe should be placed along the base of the wall, and connected to an approved discharge location. A typical retaining wall drainage detail is provided on Plate 3.

Drainage

Perched groundwater should be anticipated in site excavations. Temporary measures to control surface water runoff and groundwater during construction would likely involve interceptor trenches and sumps.

Surface grades must be designed to direct water away from buildings. The grade adjacent to buildings should be sloped away from the buildings at a gradient of at least 2 percent for a horizontal distance of ten feet. In our opinion, perimeter footing drains should be installed at or below the invert of the building footings. A typical footing drain detail is provided on Plate 4 of this report.

Surface water should not be allowed to flow over the existing slopes in either a temporary or permanent condition.

Dispersion

Based on the referenced preliminary site plan, infiltration/dispersal trenches are planned as part of the storm drainage for the proposed development. In our opinion, the proposed dispersion trenches should be located at least 25 feet from the top of on-site steep slope areas.

Infiltration

Based on the soil conditions observed during subsurface exploration, in our opinion, limited infiltration within the native soils is feasible. The native soils observed throughout the test pit locations consist of loamy sand (USDA classification). For preliminary design, we will provide a recommended infiltration rate based on Table 3.7 of Section 3.3.6 of the DOE Manual and the soil conditions observed at the test pit locations. Based on review of the soil data and referenced DOE Manual, the following infiltration rate is recommended for design:

- **Recommended Preliminary Infiltration Rate** **0.3 in./hr.**

The above recommended preliminary infiltration rate is based on infiltration within the upper weathered till soils. The geotechnical engineer should observe the excavations for the proposed infiltration system to confirm soil conditions at the time of construction. An overflow provision should be incorporated into the infiltration and stormwater design. Infiltration trenches should be located with a setback of at least 20 feet from the top of the steep slope areas.

We understand infiltration trenches will be constructed within fill areas. Per section 3.1.1 of the DOE Manual, infiltration in fill areas is permissible if the infiltration rate of the fill is measured to be at least 8 in./hr. In our opinion, fill to be placed within infiltration areas should consist of a relatively clean (typical) pit-run material. ESNW should confirm suitability of the proposed infiltration fill material prior to placement.

Utility Support and Trench Backfill

In our opinion, the soils anticipated to be exposed in utility excavations should generally be suitable for support of utilities. Existing fill, organic or highly compressible soils encountered in the trench excavations should not be used for supporting utilities. The native soils are moisture sensitive and will therefore be difficult to use as structural trench backfill. Moisture conditioning of the soils will likely be necessary prior to use as structural backfill. Utility trench backfill should be placed and compacted to 95 percent of the modified proctor, or to the applicable city or utility district specifications.

Pavement Sections

The performance of site pavements is largely related to the condition of the underlying subgrade. To ensure adequate pavement performance, the subgrade should be in a firm and unyielding condition when subjected to proofrolling with a loaded dump truck. Structural fill in pavement areas should be compacted to the specifications detailed in the *Site Preparation and Earthwork* section of this report. It is possible that soft, wet, or otherwise unsuitable subgrade areas may still exist after base grading activities. Areas of unsuitable or yielding subgrade conditions may require remedial measures such as overexcavation and thicker crushed rock or structural fill sections prior to pavement. Cement treatment of the subgrade soil can also be considered for stabilizing pavement subgrade areas.

For relatively lightly-loaded pavements subjected to automobiles and occasional truck traffic, the following sections can be considered for preliminary design purposes:

- Two inches of hot mix asphalt (HMA) placed over four inches of crushed rock base (CRB), or;
- Two inches of HMA placed over three inches of asphalt treated base (ATB).

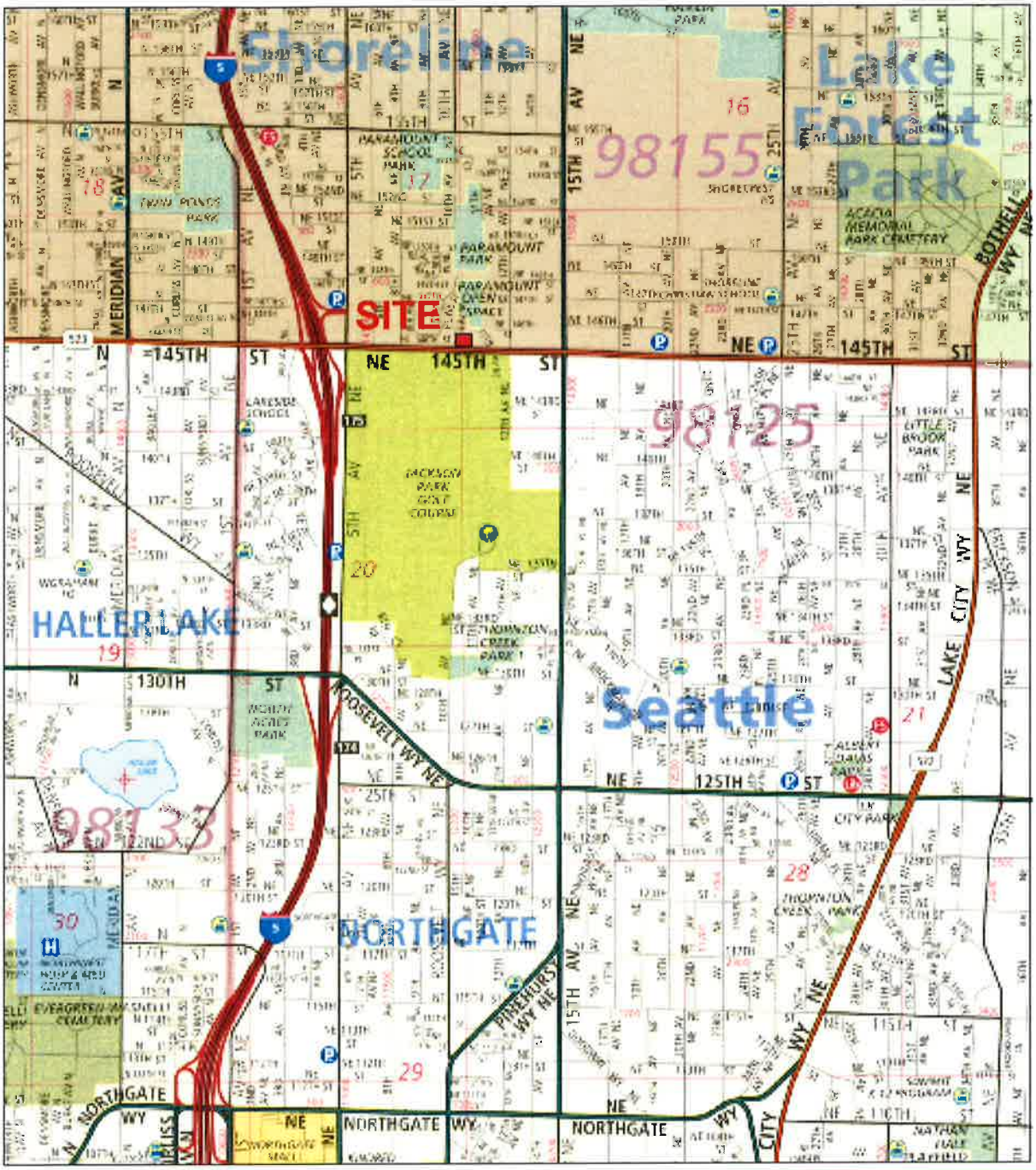
The HMA, ATB and CRB materials should conform to WSDOT specifications.

LIMITATIONS

The recommendations and conclusions provided in this geotechnical engineering study are professional opinions consistent with the level of care and skill that is typical of other members in the profession currently practicing under similar conditions in this area. A warranty is not expressed or implied. Variations in the soil and groundwater conditions observed at the test locations may exist, and may not become evident until construction. ESNW should reevaluate the conclusions in this geotechnical engineering study if variations are encountered.

Additional Services

ESNW should have an opportunity to review the final design with respect to the geotechnical recommendations provided in this report. ESNW should also be retained to provide testing and consultation services during construction.



Reference:
King County, Washington
Map 505
By The Thomas Guide
Rand McNally
32nd Edition

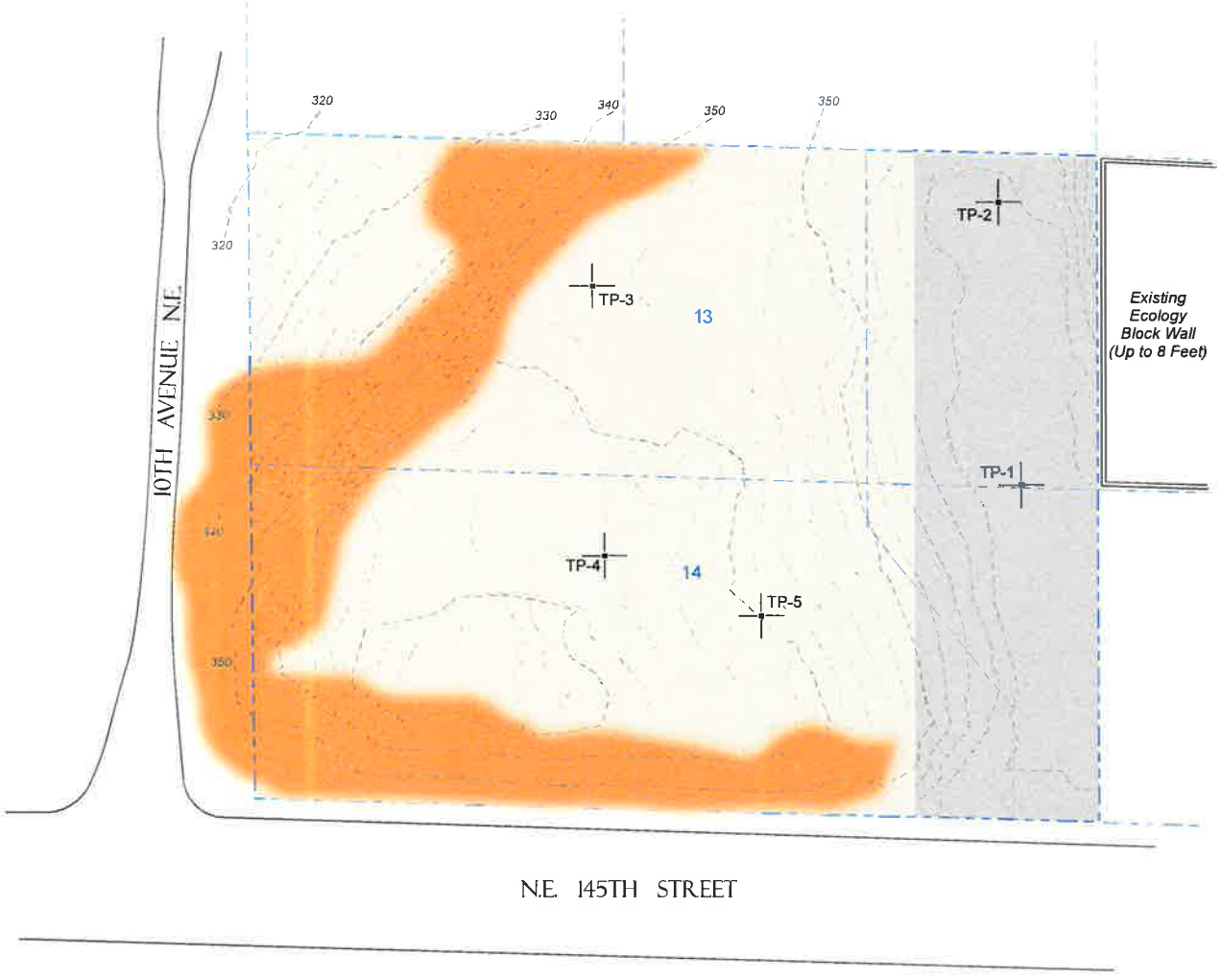
NORTH

NOTE: This plate may contain areas of color. ESNW cannot be responsible for any subsequent misinterpretation of the information resulting from black & white reproductions of this plate.

Earth Solutions NW LLC
Geotechnical Engineering, Construction Monitoring and Environmental Sciences

Vicinity Map
Layton Crossing
Shoreline, Washington

Drwn. GLS	Date 04/22/2014	Proj. No. 3304
Checked HTW	Date April 2014	Plate 1



NORTH

1"=40'

0 20 40 80

Scale in Feet

LEGEND

TP-1 — Approximate Location of ESNW Test Pit, Proj. No. ES-3304, April 2014

Subject Site

Approximate Area of Steep Slope (Delineated By Others)

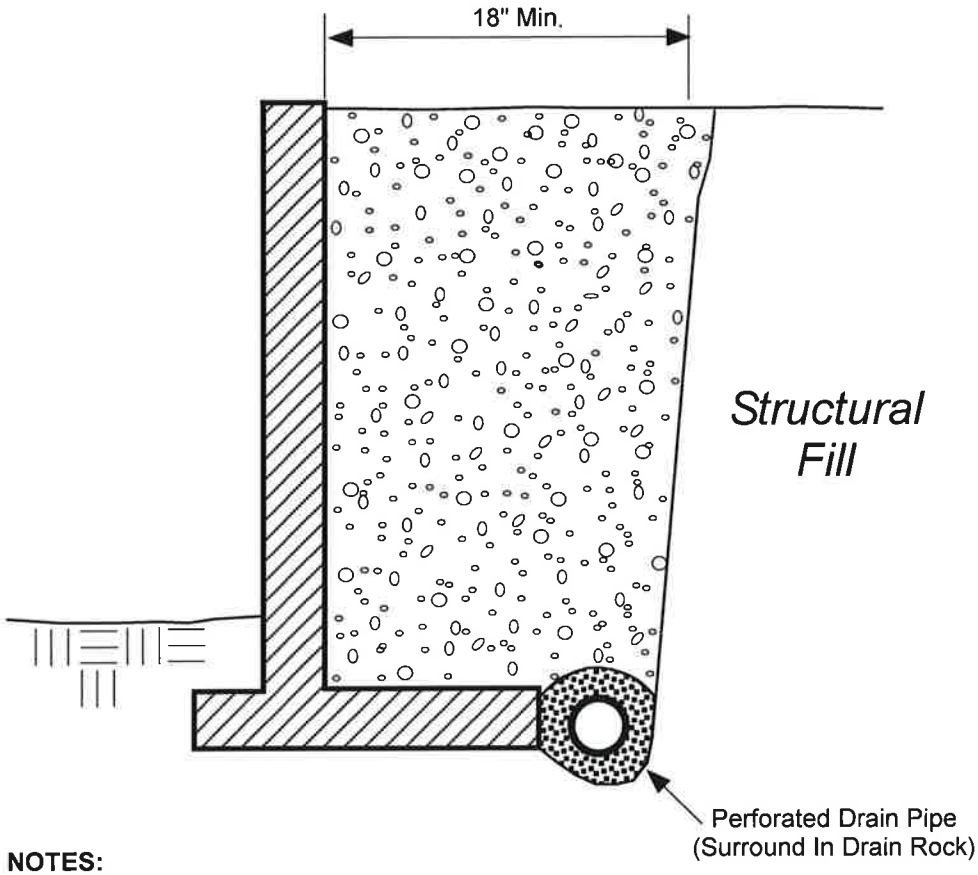
NOTE: The graphics shown on this plate are not intended for design purposes or precise scale measurements, but only to illustrate the approximate test locations relative to the approximate locations of existing and / or proposed site features. The information illustrated is largely based on data provided by the client at the time of our study. ESNW cannot be responsible for subsequent design changes or interpretation of the data by others.

NOTE: This plate may contain areas of color. ESNW cannot be responsible for any subsequent misinterpretation of the information resulting from black & white reproductions of this plate.

Test Pit Location Plan
Layton Crossing
Shoreline, Washington

Earth Solutions NW LLC
Geotechnical Engineering, Construction Monitoring and Environmental Sciences

Drwn. By	GLS
Checked By	HTW
Date	04/22/2014
Proj. No.	3304
Plate	2



NOTES:

- Free Draining Backfill should consist of soil having less than 5 percent fines. Percent passing #4 should be 25 to 75 percent.
- Sheet Drain may be feasible in lieu of Free Draining Backfill, per ESNW recommendations.
- Drain Pipe should consist of perforated, rigid PVC Pipe surrounded with 1" Drain Rock.

SCHEMATIC ONLY - NOT TO SCALE
NOT A CONSTRUCTION DRAWING

LEGEND:

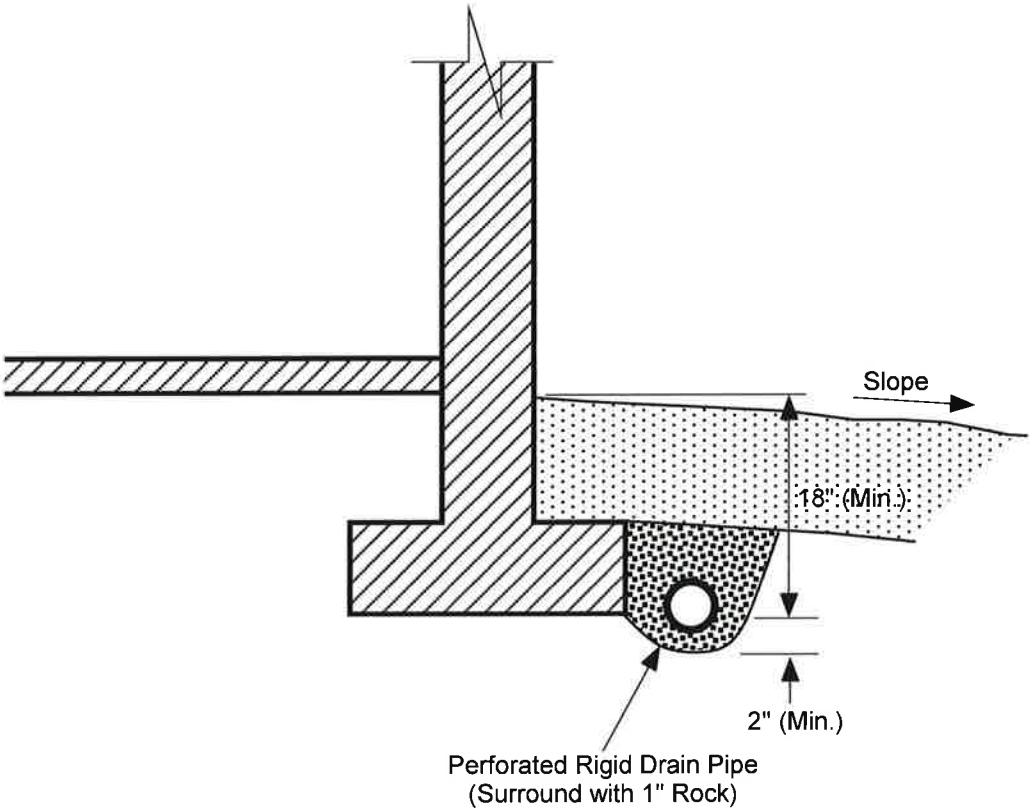
Free Draining Structural Backfill

1 inch Drain Rock

Earth Solutions NW LLC
Geotechnical Engineering, Construction Monitoring and Environmental Sciences

RETAINING WALL DRAINAGE DETAIL
Layton Crossing
Shoreline, Washington

Drwn. GLS	Date 04/22/2014	Proj. No. 3304
Checked HTW	Date April 2014	Plate 3



NOTES:

- Do NOT tie roof downspouts to Footing Drain.
- Surface Seal to consist of 12" of less permeable, suitable soil. Slope away from building.

LEGEND:

Surface Seal; native soil or other low permeability material.

1" Drain Rock

SCHEMATIC ONLY - NOT TO SCALE
NOT A CONSTRUCTION DRAWING

Earth Solutions NW LLC
Geotechnical Engineering, Construction Monitoring and Environmental Sciences

FOOTING DRAIN DETAIL
Layton Crossing
Shoreline, Washington

Drwn. GLS	Date 04/22/2014	Proj. No. 3304
Checked HTW	Date April 2014	Plate 4

Appendix A

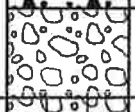
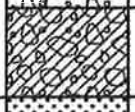
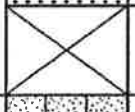
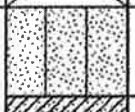
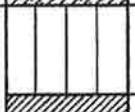
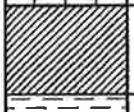
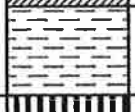
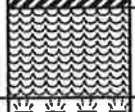
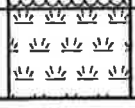
Subsurface Exploration

ES-3304

The subsurface conditions at the site were explored by excavating a total of five test pits across accessible portions of the property. The subsurface exploration was completed on April 9, 2014. The approximate test pit locations are illustrated on Plate 2 of this report. Logs of the test pits are provided in this Appendix.

Earth Solutions NW LLC

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	SAND AND SANDY SOILS	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

DUAL SYMBOLS are used to indicate borderline soil classifications.

The discussion in the text of this report is necessary for a proper understanding of the nature of the material presented in the attached logs.

Earth Solutions NW
1805 - 136th Place N.E., Suite 201
Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-1

CLIENT Sudquist Homes, LLC
PROJECT NAME Layton Crossing
PROJECT NUMBER 3304
PROJECT LOCATION Shoreline, Washington
DATE STARTED 4/9/14 **COMPLETED** 4/9/14
GROUND ELEVATION 341 ft **TEST PIT SIZE**
EXCAVATION CONTRACTOR NW Excavating
GROUND WATER LEVELS:
EXCAVATION METHOD
AT TIME OF EXCAVATION ---
LOGGED BY HTW **CHECKED BY** HTW
AT END OF EXCAVATION ---
NOTES Depth of Topsoil & Sod 6": grass
AFTER EXCAVATION --

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0			TPSL		TOPSOIL to 6"	340.5
		MC = 5.30%	SM		Brown silty SAND with gravel, loose to medium dense, moist (Fill)	
					3.0	338.0
		MC = 8.70%	SM		Brown silty SAND with gravel, medium dense, moist (Weathered Till)	
5					6.0	335.0
		MC = 8.10%	SM		Gray silty SAND with gravel, medium dense to dense, moist (Unweathered Till)	
					8.0	333.0
					Test pit terminated at 8.0 feet below existing grade. No groundwater encountered during excavation.	
					Bottom of test pit at 8.0 feet.	

Earth Solutions NW
1805 - 136th Place N.E., Suite 201
Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-2

CLIENT Sudquist Homes, LLC
PROJECT NAME Layton Crossing
PROJECT NUMBER 3304
PROJECT LOCATION Shoreline, Washington
DATE STARTED 4/9/14 **COMPLETED** 4/9/14
GROUND ELEVATION 342 ft **TEST PIT SIZE**
EXCAVATION CONTRACTOR NW Excavating
GROUND WATER LEVELS:
EXCAVATION METHOD
AT TIME OF EXCAVATION ---
LOGGED BY HTW **CHECKED BY** HTW
AT END OF EXCAVATION ---
NOTES Depth of Topsoil & Sod 4": grass
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0					(4" Topsoil) Brown silty SAND with gravel, loose to medium dense, moist (Weathered Till)
		MC = 11.70% Fines = 14.90%	SM		[USDA Classification: very gravelly loamy SAND]
3.5					338.5 Gray silty SAND with gravel, dense, moist (Unweathered Till)
5		MC = 10.90%	SM		-slightly cemented
		MC = 10.50%			
6.5					335.5 Test pit terminated at 6.5 feet below existing grade. No groundwater encountered during excavation. Bottom of test pit at 6.5 feet.

Earth Solutions NW
1805 - 136th Place N.E., Suite 201
Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-3

CLIENT Sudquist Homes, LLC
PROJECT NAME Layton Crossing
PROJECT NUMBER 3304
PROJECT LOCATION Shoreline, Washington
DATE STARTED 4/9/14 **COMPLETED** 4/9/14
GROUND ELEVATION 357 ft **TEST PIT SIZE**
EXCAVATION CONTRACTOR NW Excavating
GROUND WATER LEVELS:
EXCAVATION METHOD
AT TIME OF EXCAVATION —
LOGGED BY HTW **CHECKED BY** HTW
AT END OF EXCAVATION —
NOTES Brambles
AFTER EXCAVATION —

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0		MC = 10.40% Fines = 15.10%	SM		Brown silty SAND with gravel, loose to medium dense, moist (Fill) -trace brick -large concrete rubble [USDA Classification: very gravelly loamy SAND]
					3.0 354.0
		MC = 10.10%	SM		Gray silty SAND with gravel, medium dense to dense, moist (Unweathered Till)
5		MC = 12.40%			-slightly cemented
					7.0 350.0
					Test pit terminated at 7.0 feet below existing grade. No groundwater encountered during excavation. Bottom of test pit at 7.0 feet.

Earth Solutions NW
1805 - 136th Place N.E., Suite 201
Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-4

CLIENT Sudquist Homes, LLC
PROJECT NAME Layton Crossing
PROJECT NUMBER 3304
PROJECT LOCATION Shoreline, Washington
DATE STARTED 4/9/14 **COMPLETED** 4/9/14
GROUND ELEVATION 366 ft **TEST PIT SIZE**
EXCAVATION CONTRACTOR NW Excavating
GROUND WATER LEVELS:
EXCAVATION METHOD
AT TIME OF EXCAVATION ---
LOGGED BY HTW **CHECKED BY** HTW
AT END OF EXCAVATION ---
NOTES Depth of Topsoil & Sod 4": grass
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			SM		(4" Topsoil) Brown silty SAND with gravel, loose to medium dense, moist (Weathered Till)
					1.5 364.5
		MC = 7.70%			Gray silty SAND with gravel, dense, moist (Unweathered Till)
					-moderately cemented
			SM		
5		MC = 8.90% Fines = 16.20%			[USDA Classification: gravelly loamy SAND]
					6.0 360.0
					Test pit terminated at 6.0 feet below existing grade. No groundwater encountered during excavation. Bottom of test pit at 6.0 feet.

Earth Solutions NW
1805 - 136th Place N.E., Suite 201
Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-5

CLIENT Sudquist Homes, LLC
PROJECT NAME Layton Crossing
PROJECT NUMBER 3304
PROJECT LOCATION Shoreline, Washington
DATE STARTED 4/9/14 **COMPLETED** 4/9/14
GROUND ELEVATION 360 ft **TEST PIT SIZE**
EXCAVATION CONTRACTOR NW Excavating
GROUND WATER LEVELS:
EXCAVATION METHOD
AT TIME OF EXCAVATION ---
LOGGED BY HTW **CHECKED BY** HTW
AT END OF EXCAVATION ---
NOTES Depth of Topsoil & Sod 4": grass
AFTER EXCAVATION --

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0					(4" Topsoil)
			SM		Brown silty SAND with gravel, loose to medium dense, moist (Weathered Till)
					1.5 358.5
					Gray silty SAND with gravel, dense, moist (Unweathered Till)
		MC = 10.30%	SM		
		MC = 8.70%			
5					5.0 -cemented 355.0
					Test pit terminated at 5.0 feet below existing grade. No groundwater encountered during excavation.
					Bottom of test pit at 5.0 feet.

GENERAL BH / TP / WELL 3304.GPJ GINT US.GDT 4/22/14

Appendix B

Laboratory Test Results

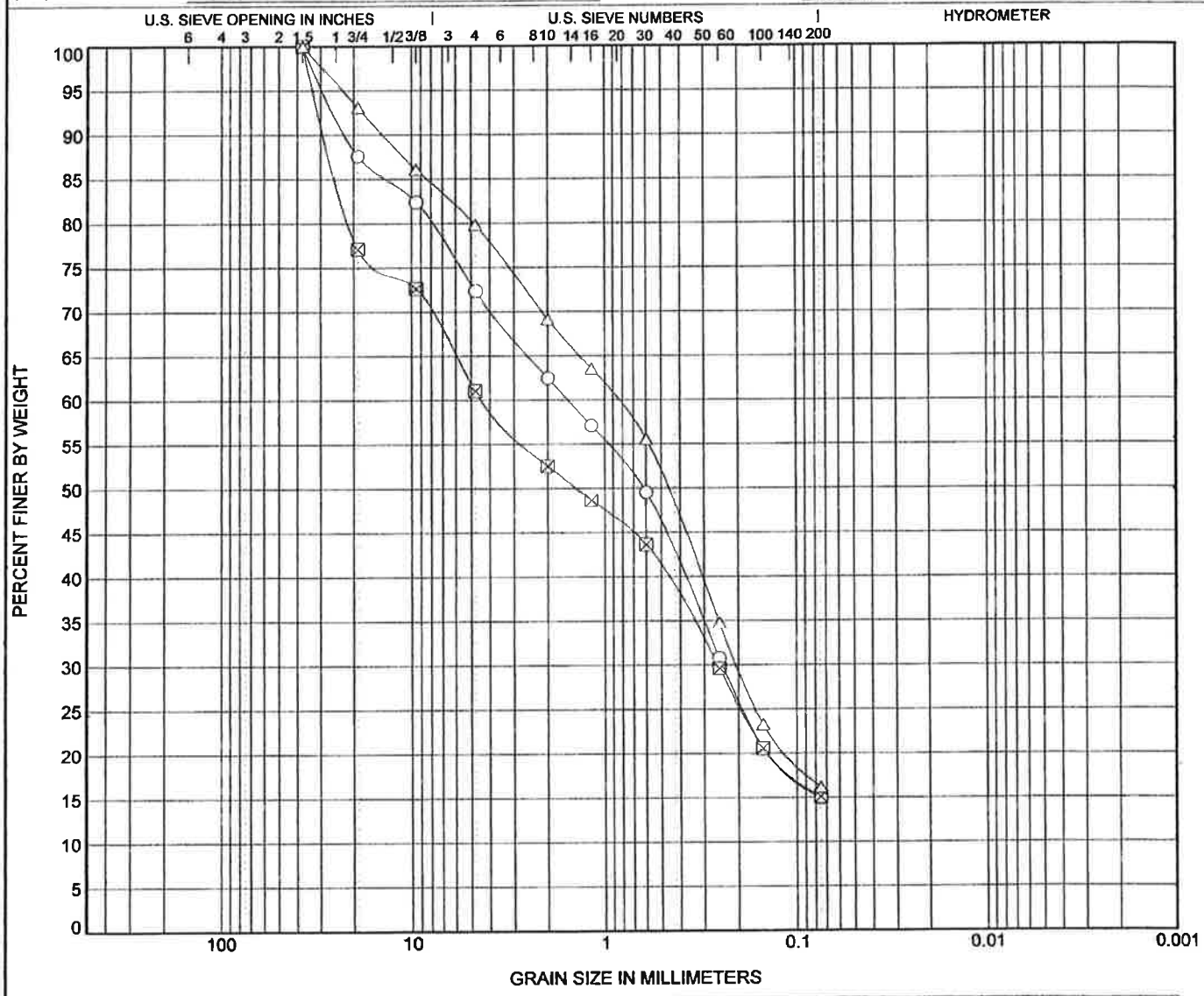
ES-3304

Earth Solutions NW
1805 - 136th Place N.E., Suite 201
Bellevue, WA 98005
Telephone: 425-284-3300

GRAIN SIZE DISTRIBUTION

CLIENT Sundquist Homes LLC **PROJECT NAME** Layton Crossing

PROJECT NUMBER ES-3304 **PROJECT LOCATION** Shoreline



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	Cc	Cu
○	TP-2	1.5ft.	USDA: Brown Very Gravelly Loamy Sand. USCS: SM w Gravel.		
☒	TP-3	1.5ft.	USDA: Brown Very Gravelly Loamy Sand. USCS: SM w Gravel.		
△	TP-4	5.0ft.	USDA: Gray Gravelly Loamy Sand. USCS: SM w Gravel.		

	Specimen Identification		D100	D60	D30	D10			%Silt	%Clay
○	TP-2	1.5ft.	37.5	1.569	0.24				14.9	
☒	TP-3	1.5ft.	37.5	4.283	0.256				15.1	
△	TP-4	5.0ft.	37.5	0.875	0.202				16.2	

GRAIN SIZE ES-3304.GPJ GINT US LAB.GDT 4/15/14

Report Distribution

ES-3304

EMAIL ONLY

Sundquist Homes, LLC
16108 Ash Way
Lynwood, Washington

Attention: Mr. Bill Keith

EMAIL ONLY

LDC, Inc.
14201 Northeast 200th Street, Suite 100
Woodinville, Washington 98072

Attention: Mr. Matthew Merritt

ESA LISTED SALMONIDS CHECKLIST

Applicant Information

Phoenix Development, LLC

Name: Eric Nordling, Project Mgr Land

Phone: 425-275-5345

Project Information

Name: Sonata PUD

Location: 21705 58th Ave W.
Mountlake Terrace, WA

Description: 31 lot - planned unit development.

This worksheet was designed to help project proponents and government agencies identify if project needs further analysis regarding adverse effects on ESA (Endangered Species Act) listed salmonids. Salmonids are salmon, trout and chars, e.g. bull trout. For our purposes, "ESA listed salmonids" is defined as fish species listed as endangered, threatened or being considered for listing.

If ESA listed species are present or ever were present in the watershed where your project will be located, your project has the potential for affecting them, and you need to comply with the ESA. The questions in this section will help determine if the ESA listings will impact your project. The Fish Program Manager at the appropriate Department of Fish and Wildlife (DFW) regional office can provide information for the following two questions. See attached list of Department of Fish and Wildlife regional offices.

1. Are ESA listed salmonids currently present in the watershed in which your project will be?

   Yes: [x] No: [ ]

   Please describe: Puget Sound Fall Chinook: adult spawning and juvenile rearing.
   Puget Sound Winter Steelhead: adult spawning and juvenile rearing.

2. Has there ever been an ESA listed salmonid stock present in this watershed?

   Yes: [x] No: [ ] Uncertain: [ ]

   Please describe: Puget Sound Fall Chinook: adult spawning and juvenile rearing.
   Puget Sound Winter Steelhead: adult spawning and juvenile rearing.

PROJECT SPECIFIC: The questions in this section are specific to the project and vicinity.

1. Name of Watershed: McAleer Creek

2. Name of nearest waterbody: Halls Lake Creek

3. What is the distance from this project to the nearest body of water? Often a buffer between the project and a stream can reduce the chance of a negative impact to fish. Halls Lake Creek is approximately 1,190 linear feet due west of the subject property on the opposite side of I-5. There is no direct surface water connection between the site and Halls Lake Creek.

4. What is the current land use between the project and the potentially affected water body (parking lots, farmland, etc.)? Current land use is a combination of single-family residential, commercial, and freeway.

5. Is the project above a:
   - Natural permanent barrier (waterfall) Yes: [ ] No: [ ]
   - Natural temporary barrier (beaver pond) Yes: [ ] No: [ ]
   - Man-made barrier (culvert, dam) Yes: [ ] No: [ ]
   - Other (explain) No natural surface water connection between the site and Halls Lake.

6. If yes, are there any resident salmonid populations above the blockage?

   Yes: [ ] No: [x] Don't know: [ ]

7. What percent of the project will be impervious surface (including pavement & roof area)?

   See site plan and drainage report.

FISH MIGRATION: The following questions will help determine if this project could interfere with migration of adult and juvenile fish. Both increases and decreases in water flows can affect fish migration.

1. Does the project require the withdrawal of:
   i. Surface water? Yes: [ ] No: [x]

   Amount: _____

   Name of surface water body: _____

   ii. Ground water: Yes: [ ] No: [x]

   Amount: _____

From where:_____

Depth of well:_____

2. Will any water be rerouted? Yes:[ ] No:[x]

   If yes, will this require a channel change?_____

3. Will there be retention ponds? Yes:[x] No:[ ]

   If yes, will this be an infiltration pond or a surface discharge to either a municipal storm water system or a surface water body? The site will have a detention vault that discharges to a municipal storm water system.

   If to a surface water discharge, please give name of waterbody._____

4. Will this project require the building of new roads? Increased road mileage may affect the timing of water reaching a stream and may thus impact fish habitat. Yes:[x] No:[ ]

5. Are culverts proposed as part of this project? Yes:[ ] No:[x]

6. Will topography changes affect the duration/ direction of runoff flows? Yes:[ ] No[x]

   If Yes, describe the changes:_____

7. Will the project involve any reduction of the floodway or floodplain by filling or other partial blockage of flows? Yes:[ ] No:[x]

   If yes, how will the loss of flood storage be mitigated by your project?_____

WATER QUALITY: The following questions will help determine if this project could adversely impact water quality. Such impacts can cause problems for listed species. Water quality can be made worse by runoff from impervious surfaces, altering water temperature, discharging contaminants, etc.

1. Do you know of any problems with water quality in any of the streams within this watershed.

   Yes:[x] No:[ ]

   If yes, please describe. Fecal coliform, phosphorous, nitrogen.

2. Will your project either reduce or increase shade along or over a waterbody? (Note: Removal of shading vegetation or the building of structures, such as docks or floats, often results in a change in shade.)

   Yes:[ ] No:[x]

3. Will the project increase nutrient loading or have the potential to increase nutrient loading or contaminants (fertilizers, other waster discharges, or runoff) to the waterbody?

   Yes:[ ] No:[x]

4. Will turbidity be increased because of construction of the project or during operation of the project? (Note: In-water or near water work will often increase turbidity.)

   Yes:[ ] No:[x]

5. Will your project require long term maintenance, i.e. bridge cleaning, highway salting, chemical sprays for vegetation management, clearing of parking lots?

   Yes:[ ] No:[x]

   If yes, please describe._____

   _____

VEGETATION: The following questions are design to determine if the project will affect riparian vegetation, thereby, adversely impacting salmon.

1. Will the project involve the removal of any vegetation from the stream banks?

   Yes:[ ] No:[x]

   If yes, please describe the existing conditions, and the amount and type of vegetation to be removed._____

   _____

2. If any vegetation is removed, do you plan to re-plant?

   Yes:[ ] No:[ ]

   If yes, what types of plants will you use?_____

   _____